Energy poverty and gender: A spatial perspective

Abstract

A burgeoning research agenda has sought to understand the significant inequalities that exist in domestic energy provision. One way in which these inequalities are shaped is through socio-spatially contingent gender relations, an area underexplored with regards to energy poverty. This paper aims to uncover the spatialities of gender and energy poverty. It argues that established energy vulnerability framings can challenge the assumption that gender inequality is synonymous with energy poverty but must move beyond a focus upon the household to recognise the vulnerability of individuals. Gendered vulnerabilities likely to enhance energy poverty are delineated for a case study of England, underpinned by socio-spatial analyses of gender-sensitive indicators. Five dimensions of gendered socio-spatial energy vulnerability are evidenced: exclusion from the economy; time-consuming and unpaid reproductive, caring or domestic roles; susceptibility to negative physiological and mental health impacts; a lack of social protection during a life course; and coping and helping others to cope. Analysis of the spatial intersections between these dimensions reveals the diverse geographies associated, that are unlikely to be accounted for by traditional poverty and energy poverty metrics.

Keywords

Gender; gender inequality; energy poverty; vulnerability; gender-sensitive indicators; spatial analysis

1. Introduction

Economic policy-making often assumes that policies affect everyone similarly, dangerously conflating the interests of the economy and its stability with the interests of the people whose wellbeing it shapes, and disregarding biases based upon gender and other forms of social difference (Perrons, 2015). However, across the Global North a renewed focus upon the relationship between gender and poverty in the wake of the Global Financial Crisis and subsequent period of austerity (Rubery, 2015) has highlighted the disproportionate impact that cuts to public spending are having upon women, particularly those in marginalised groups (A Fairer Deal for Women, 2016), disrupting and in places reversing progress towards gender equality (Perrons, 2015).

Concern about the distributional and recognition injustices associated with neo-liberalism and austerity have also prompted a drive to understand the socio-spatial vulnerabilities that enhance energy poverty (Walker and Day, 2012), a unique form of material deprivation concerned with access to sufficient domestic energy services (Buzar, 2007). Energy poverty (often referred to as fuel poverty) has featured on policy agendas in the United Kingdom (UK), where the term was first mobilised, for several decades due to negative impacts upon health and wellbeing (Boardman, 1991). Here the neo-liberalisation of two key institutional and infrastructural arrangements, energy markets and housing markets, and deepening of relative inequality, has played a significant role in the manifestation of new energy poverty challenges. A growing body of research has begun to explore in greater depth the socio-spatial vulnerabilities that increase the likelihood of experiencing energy poverty in this context (Bouzarovski and Petrova, 2015, Middlemiss and Gillard, 2015). However, largely missing from the conversation is gender.

Drawing upon decades of feminist scholarship, here gender is understood as the social, economic and political constructions of 'femininity' and 'masculinity', a fundamental axis of social power that shapes social relations in an unequal way (McDowell, 1999). Central to such scholarship is the understanding that gender is not, however, a discrete category. Rather it is mutually constructed with other forms of social difference including class, ethnicity, race, disability, able-ness and age (Beneria and Roldan, 1987, Crenshaw, 1991). For McDowell (1999) these interconnections with other axes of social power and oppression mean that gender relations are constituted in varied and uneven ways over space and time. McDowell highlights how 'the advantages and disadvantages conferred by the social constructions of masculinity vary across space and time, as they intersect with class relations, labour market changes and the geographically specific relations of place' (2016: 2093). Likewise, Massey, in conceptualising the relationship between gender and space, argues that 'what it means to be masculine in the Fens is not the same as in Lancashire' (1994:179). Geographical variations in gender relations, it is argued, are integral to the construction and reproduction of geography either through their contribution towards uneven development or regional and local variations (Massey, 1994, McDowell, 2007). By contrast, existing development-focused, energy poverty literatures have tended to promote binary, disempowering and victimising gender discourses (Listo 2018, Petrova and Simcock (Under review). Petrova and Simcock (Under review) challenge this dichotomy, recognising the need for research that scrutinises the uneven, gendered geographies of energy deprivation.

Subsequently, this paper aims to uncover the spatialities of gender and energy poverty. After outlining how existing energy vulnerability framings can be adapted to explore gender relations, I derive a series of gender-sensitive vulnerability indicators in relation to energy poverty at a neighbourhood-scale for a case study of England. The analysis is what McCall

(2005) terms inter-categorical, *necessarily* adopting existing analytical categories (including women and men) to highlight processes of marginalisation. A socio-spatial analysis of the indicators reveals some of the diverse and contradictory geographies of gendered vulnerability to energy poverty.

2. Gender inequality and poverty

In the Global North there is a concern with *relative* poverty, occurring amongst individuals whose resources are so seriously below those commanded by the average that they are excluded from ways of living customary of their society (Townsend, 1979). Inspired by the concept of relative poverty, Buzar (2007) defines the energy poor as those living without access to the socially and materially necessary domestic energy services (for example, heating, lighting or cooking) to allow their meaningful participation in the society in which they live. Buzar's definition emphasises the integral role of energy-related infrastructures in distinguishing energy poverty from poverty. The relative condition of poverty and energy poverty can be thought of as a negative outcome of a diverse set of socio-economic and structural relations and inequalities, many of which as I will demonstrate, are intertwined with gender.

Understanding of gender as a fundamental axis of social power that, through interconnections with other axes of difference, shapes social relations in an unequal way has not always been central to gender and poverty conversations. During the 1980's the '*feminisation of poverty*' agenda (Pearce, 1978) sought to highlight the disproportionate number of women experiencing poverty. Whilst elevating gender in international poverty discourses (Chant, 2008), the conceptualisation perceived gender issues as a variation of poverty, and poverty alleviation as the primary means to improve the position of women

(Jackson, 1996, Chant, 2004, 2006, 2008). The agenda ignored how gender can be distinct from and contradict poverty, and how poverty is a negative outcome of unequal social relations that are shaped by gender rather than *vice versa*. Multi-dimensional aspects of gender disadvantage such as housing, basic services (including energy) and rights were also overlooked (Sen, 1999, Razavi, 1999, Chant, 2004). Constructing women as a somewhat homogenous group, a 'lack of breakdown according to other axes of difference prevented any dedicated investigation of which particular groups of women… might be especially prone to privation' (Chant, 2006: 204).

These shortcomings have been challenged by intersectional feminism that contests the idea that women experience oppression and disadvantage in a similar way (Beneria and Roladan, 1987, Crenshaw, 1991, Davis, 2008, McCall, 2005, Shields, 2008). Gender inequality varies in its configuration and intensity due to interconnections with other axes of social difference and oppression including race, ethnicity, disability and able-ness, sexuality and age. These interconnections mean that gender relations are constituted in varied and uneven ways over space and time and are integral to the construction and reproduction of geography (McDowell, 1999, 2016, Massey, 1994). For Kabeer (2011), the pervasive nature of gender inequality means that it cuts across spatial inequalities in addition to social inequalities, taking different forms in different societies. Thus 'women's poverty is experienced in different ways, at different times, in different "spaces"' (Bradshaw, 2002:12). A more nuanced understanding of the socio-spatial variability of relations between gender inequality and poverty has subsequently emerged but has rarely translated into energy poverty research that often fails to mention gender.

Clancy et al. (2017) emphasise the need for improved understanding of gender inequality in relation to energy in the first comprehensive review in the context of the European Union (EU). The review stresses the need for gender to be accounted for in the definition and

measurement of energy poverty, through the derivation of indicators that are sensitive to gender. However, the small amount of literature that seeks to understand the relationship between gender and energy poverty is primarily development-focused and has been critiqued for endorsing a "feminization of energy deprivation" (Petrova and Simcock, Under review: 1) and promoting binary, disempowering and victimising gender discourses (Listo, 2018). Listo (2018) documents how the issue is often depoliticised by a failure to recognise how a lack of energy services is just one way that gender inequalities are materially expressed, and that gender inequalities are in fact generated by unequal power relations between men and women, and other groups. In some cases, women are co-opted and instrumentalised to justify energy-related interventions at the expense of gender equality. The assumption that gender inequality is resolvable with these interventions conceals the power relations that cause gender inequalities to manifest.

A recent publication by Petrova and Simcock represents the only concentrated effort to move beyond disempowering narratives, drawing upon qualitative household-scale research in several European cities to explore the "overlooked politics of mundane energy use-related practices in both constituting, and being constituted of, gender…inequities" (Under review: 1). They illustrate ways in which experiences of energy poverty in the home are differentiated along gender lines, emphasising the gendered agency of household members who are actively involved in household decision-making. However, recognition of gender as a system of disadvantage also needs to extend beyond a focus upon the home to scrutinise the uneven, gendered geographies of energy deprivation at different scales. In response, the analysis that follows uncovers the spatialities of gender and energy poverty at a neighbourhood-scale through the first quantitative, spatial assessment of gendered energy vulnerability to date.

3. Gendered socio-spatial vulnerability to energy poverty

To better understand the relationship between gender inequality and energy, in particular the spatialities of this relationship, the concept of vulnerability can be mobilised. Vulnerability explains the differential losses between varied societal groups and places arising from a stressor, identifying the characteristics of those most susceptible to harm and the likelihood of them experiencing negative outcomes (Adger, 2006, Cutter et al., 2003), and providing a means of mitigating against threats to people's integrity (Middlemiss and Gillard, 2015). To date, the framing has been used to highlight several dimensions that increase the likelihood of a household experiencing energy poverty: unaffordability of energy, energy inefficiency, inflexibility in the built environment including tenure arrangements, and energy-related needs and practices that increase energy use (Bouzarovski and Petrova, 2015, Middlemiss and Gillard, 2015). Meanwhile, the complimentary precarity framework (Petrova, 2017), explores wider institutional factors that contribute. These framings highlight how vulnerability manifests in households with a range of socio-economic, demographic and socio-technical characteristics. Attention is also drawn to the uneven spatial distribution of energy-related vulnerability (Buzar, 2007, Bouzarovski et al., 2017, Bouzarovski and Thomson, 2018) and its temporal variability as household circumstances change (Middlemiss and Gillard, 2015).

Within energy vulnerability research there have been comparatively fewer conversations about gender. This can be partially explained by a reluctance to associate gender inequality with a concept that, if applied without careful thought, can reinforce detrimental discourses that have characterised women as vulnerable, submissive and repressed, and fail to reflect individual agency (Listo, 2018). Day and Hitchings (2011) exploring energy poverty amongst older age groups highlight how labelling groups as vulnerable can be counterproductive to

relieving marginalisation. However, in articulating feminist intersectionality, Crenshaw (1991) contradicts the view that identity categories are negative frameworks that marginalise those who are different and should be dismantled, arguing that delineation of difference can be a form of social power and that intra-group differences cannot be ignored. Walker and Day (2012) recognise the importance of making visible social vulnerabilities to address associated injustices.

In seeking to understand the ways in which the socio-spatial inequalities that give rise to energy poverty are gendered, the vulnerability framing has two key strengths. Firstly, it contradicts the common assumption that gender inequality is synonymous with poverty (Jackson, 1996, Listo, 2018). By focusing upon the likelihood of falling into the condition of energy poverty, it is not assumed that gender inequality is just one aspect of deprivation. Rather, it is possible to demonstrate how gender inequality, through its intersection with other axes of social differentiation, results in a greater exposure to energy poverty's negative impacts amongst marginalised women. Secondly, it provides a powerful means of recognising socio-spatial differentiations in the degree of susceptibility to energy poverty, helping to conceptualise the intersections and the mutually reinforcing relations between gender and other axes of social (*socio*) difference, including ethnicity, race, disability and age, and how these inequalities manifest in certain places (*-spatial*) with varying intensity.

Outlining a global framing of vulnerability to energy poverty, Bouzarovski and Petrova note the importance of 'the individual, household and community-level determinants of energy dynamics in the residential environment' (2015: 35). Yet, to date Tirado Herrero recognises 'a fundamental assumption in the energy poverty and domestic energy use literature, that takes households – not individuals – as the key micro unit" (2017: 1026). A focus on the household is justifiable given the importance of infrastructure in domestic energy-related inequalities. However, it also wrongly assumes an equitable distribution of resources

amongst household members, making research somewhat 'gender-blind' (Millar and Glendinning, 1989). Gender, rather than being included as a variable within existing analyses, requires a different analytical framework (Millar and Glendinning 1989). In response, an individual deprivation measure (IDM) has been proposed that illuminates rather than obscure gender inequality (Bessell, 2015). However, this has rarely been absorbed by mainstream poverty metrics. Subsequently, to succeed in understanding gender inequality, energy vulnerability framings must move beyond a concern with the household to the individual. With this framing in mind, I turn my attention to deriving a selection of gender-sensitive indicators of vulnerability to energy poverty.

4. Deriving gender-sensitive indicators of vulnerability to energy poverty

Building upon the recommendations of Clancy et al. (2017), gender-sensitive indicators of vulnerability to energy poverty are derived and analysed for neighbourhoods across England. These indicators provide understanding of the relationship between gender inequality and energy and allow for relative comparison of the socio-spatial distribution of gendered energy vulnerabilities.

In such an analysis, the way in which administrative datasets are collated necessitates relying upon the binary of women and men as a proxy for gender, in addition to other fixed categories of social difference including disability, age and ethnicity (ONS, 2011a.). These categorisations can obscure a variety of identities and imply that predefined social groups can be incrementally added to one another to understand the depth of a person's marginalisation. This falsely dichotomises and concretises what are inherently entangled forms of oppression (Butler, 1990, Valentine, 2007). However, whilst imperfect, the categorisations have a useful role in making visible the positions and outlooks of all women

and supporting research that leads to social change (DeVault, 1996, McLafferty, 1995, Spraque and Zimmerman, 1993). The analysis is therefore what McCall terms an *intercategorical* approach that "provisionally adopts analytical categories to document relationships of inequality amongst social groups and changing configurations of inequality along multiple conflicting dimensions" (2005: 1773). The categories of women and men provide an 'anchor point' from which to explore their relationality with other axes of social difference (Glenn, 2002). The analysis combines two methodological approaches.

The first approach asks - *which aspects of energy vulnerability are likely to be gendered?* Unlike many established sub-regional deprivation indexes that represent gender using the percentage of females and males within each geographical unit (Cutter et al., 2003), the analysis does not begin with the assumption that women are more vulnerable to energy poverty. Instead it investigates whether well-understood aspects of energy vulnerability are gendered. From an existing typology of vulnerability indicators underpinned by an extensive review of qualitative research (AUTHOR, Under review), representative indicator datasets are identified from the 2011 Census (ONS 2011a.). The datasets must be available at the Lower Super Output Area (LSOA) neighbourhood scale (representing on average 1500 individuals), have the individual as the primary unit of analysis within the neighbourhood, and be disaggregated by sex (ONS 2011b.). A One-Way ANOVA test determines whether there is a statistically significant, gendered aspect to each indicator, i.e. whether females are over-represented. Due to dataset restrictions, cross-clarification of the gender-sensitive indicators to reveal interconnections with other forms of social difference is not possible, restricting the analysis to an additive linear model (McCall, 2005).

To overcome these limitations, the second stage of the analysis asks – *how is gendered energy vulnerability spatially distributed?* in addition to - *how do gendered aspects of vulnerability spatially*

intersect? A Local Indicator of Spatial Association (LISA) (Anselin, 1995) identifies local patterns of association, including 'hot' spots (high-high clusters) and 'cold' spots (1 clusters) of vulnerability according to each gender-sensitive indicator, providing information about its relative distribution between neighbourhoods across England (Table 1). In the cluster analysis each LSOA is represented by a population weighted centroid, a single point reflecting the concentration of population within the small area (ONS, 2011b) (Waller and Gorway, 2004. A spatial weights matrix conceptualises the spatial relationship for the cluster analysis using the eight nearest neighbours to reflect how urban areas tend to be more spatially concentrated. These clusters and outliers are statistically significant for a 95% confidence level. These cluster analyses are overlaid to consider spatial interconnections amongst the indicators, and subsequently the role of other forms of social difference in gender differentiations in energy vulnerability. The gender-sensitive indicators provide insight into the variety and geography of gendered vulnerabilities that enhance the likelihood of energy poverty.

Table 1. Local Moran's I clusters and outliers

Cluster or outlier	Description	Local Moran's I Z-score
High-high (HH) Cluster	'Hot spot' of high values due to the local association of LSOA in which a high percentage of individuals are vulnerable	> 0
High-low (HL) Outlier	A high value surrounded by predominantly low values	< 0
Low high (LH) Outlier	A low value surrounded by predominantly high values	< 0
Low-low (LL) Cluster	'Cold spot' of low values due to the local association of LSOA in which a low percentage of individuals are vulnerable	> 0

4. A typology of gender-sensitive indicators of vulnerability to energy poverty

From AUTHOR's typology (Under review), 13 indicator datasets are obtained that fulfil the selection criteria (Table 2). Each is analysed to understand whether women are disproportionately represented relative to their male counterparts (Table 3). Nine gender-sensitive indicators of vulnerability to energy poverty are retained: older age, disability and illness, lone parent, part-time employment, looking after family or home, provision of unpaid care, proficiency in English, fulltime student and pensionable age and living alone. It is worth noting that, although these indicators highlight characteristics associated with a greater susceptibility to energy poverty, it should not be assumed that all individuals represented will be energy poor. The typology of indicators does not consider how vulnerability amongst women might also be alleviated by certain factors, or how the intensity of vulnerability varies between indicators. In the section that follows, cluster analyses of the nine gender-sensitive indicators (Table 4, Figure 1) are situated within a review of energy poverty literatures to explore the spatialities of gender and energy poverty.

Table 2. Vulnerability indicators and datasets that can be broken down by sex

Vulnerability indicator[1]	Y/N[2]	New indicator dataset (by sex) (ONS 2011a)
Older old	Y	Over 75 years
Young children	N	-
Disability and limiting illness	Y	Day-to-day activity is limited a lot
Lone parent	Y	Lone parent with dependent children
Part-time occupation	Y	Part-time employment
Retired	Y	Full time students
Looking after family or home	Y	Looking after family or home
Provision of unpaid care	Y	Providing unpaid care (20+ hours)
Unemployment	Y	Unemployed
Elementary occupation	Y	Elementary occupation
Proficiency in English	Y	Can't speak English well or can't speak English
Ethnicity	Y	Persons whose ethnic group is non-British
Full time student	Y	Fulltime students
Living alone	Y	Aged over 65 years and living alone
Under-occupancy	N	-
Shared property (HMO)	N	-
Large household size	N	-
Private renting	N	-
No central heating	N	-
No access to gas network	N	-
Inefficient property	N	-
Low outdoor temperature	N	-

[1] *Extracted from AUTHOR (Under review)*

[2] *Is a sub-regional indicator dataset available using unit of individual, and broken down by sex? Yes (Y) or no (N)*

Table 3. Summary statistics and One-Way ANOVA for vulnerability indicators, broken down by sex

Indicator *ONS (2011a.)*	Females (% values for LSOA)				Males (% values for LSOA)				One-Way ANOVA			Gender-sensitive indicators for further analysis (unit)
	Mean	Min	Max	SD	Mean	Min	Max	SD	Mean sq.	F	Sig.	
Older old	9.17	0.00	47.98	4.83	6.54	0.00	36.55	3.45	114354.53	6438.714	0.00*	Aged over 75 years old (% females)
Disability or limiting illness	18.40	2.70	59.03	5.48	16.18	1.80	51.5	5.17	80767.14	2845.31	0.00*	Day-to-day activities limited a lot (% females)
Lone parent	7.23	34.06	0.00	4.35	0.80	0.00	12.29	0.58	678886.89	70479.07	0.00*	Lone parent (% females, 16-74 yrs)
Part-time employment	21.50	0.91	37.83	4.35	6.10	0.55	28.11	2.07	3893883.09	250757.18	0.00*	Part-time employment (% females 16-74 yrs)
Looking after home	7.87	0.09	37.78	3.85	0.83	0.00	5.97	0.66	813497.55	106461.52	0.00*	Looking after family or home (% females 16-74 yrs)
Provision of unpaid care	4.42	0.00	12.23	1.54	3.19	0.00	11.11	1.30	25073.20	12331.80	0.00*	Provision of unpaid care, (% females 16-74 yrs)
Unemployment	3.51	0.00	15.80	2.00	5.30	0.16	26.44	3.12	52864.05	7710.66	0.00*	*Statistically significant for males*
Elementary occupation	11.18	0.25	45.71	5.45	11.88	0.45	46.41	5.77	7942.27	252.27	0.00*	*Statistically significant for males*
Proficiency in English	1.85	0.00	37.95	3.35	1.28	0.00	23.44	2.08	5359.57	690.05	0.00*	Proficiency in English, (% females 16 yrs+)
Ethnicity	19.42	0.32	99.23	22.41	19.10	0.00	99.73	22.12	1742.36	3.52	0.61	*No statistically significant difference*
Student	8.73	0.86	91.02	7.47	8.46	1.17	93.91	7.32	1138.45	20.82	0.00*	Fulltime students (% females 16-74 yrs)
Pensionable age/ living alone	7.22	0.00	41.49	3.65	3.33	0.00	28.22	1.65	247821.13	30951.18	0.00*	Living alone and over 65 years old (% females)

Table 4. Local Moran's I for gender-sensitive vulnerability indicators

Cluster or outlier	LSOA (count)	Mean z-score (p value)[1]	Min. value (%)	Max. value (%)	Mean value (%)
Older old					
Not significant	25955	0.23 (0.64)	0.13	33.93	9.23
HH cluster	2803	5.90 (<0.05)	10.94	47.98	18.12
HL outlier	197	-2.83 (<0.05)	12.14	34.69	17.81
LH outlier	203	-2.88 (<0.05)	0.17	7.88	4.12
LL cluster	3686	3.47 (<0.05)	0.00	6.43	3.23
Disability and illness					
Not significant	24579	0.73 (0.61)	4.96	40.00	18.18
HH cluster	4060	4.81(<0.05)	20.49	47.49	27.06
HL outlier	172	-3.0(<0.05)	20.83	59.04	26.41
LH outlier	182	-2.92(<0.05)	4.95	15.92	11.65
LL cluster	32844	4.15(<0.05)	1.49	15.91	10.68
Lone parent					
Not significant	26854	0.33 (0.60)	0.20	30.81	6.42
HH cluster	3855	6.54 (<0.05)	8.53	34.06	15.23
HL outlier	122	-2.72 (<0.05)	10.77	24.02	15.03
LH outlier	225	-2.78 (<0.05)	0.26	5.62	3.31
LL cluster	1788	2.67 (<0.05)	0.00	4.59	2.24
Part-time employment					
Not significant	23688	0.39 (0.64)	4.18	35.7	22.36
HH cluster	3834	3.58 (<0.05)	23.87	37.83	28.28
HL outlier	18	-2.87 (<0.05)	25.21	33.83	27.60
LH outlier	37	-2.62 (<0.05)	4.89	18.95	14.88
LL cluster	5267	8.15 (<0.05)	0.91	19.69	12/73
Looking after family or home					
Not significant	27194	0.34 (0.65)	0.28	22.85	7.29
HH cluster	3254	11.86 (<0.05)	8.81	37.78	15.69
HL outlier	75	-2.85 (<0.05)	10.36	22.43	14.56
LH outlier	103	-3.47 (<0.05)	1.04	6.77	4.34
LL cluster	2218	2.97 (<0.05)	0.09	5.80	3.41
Provision of unpaid care					
Not significant	23817	0.34 (0.61)	0.37	9.49	4.34
HH cluster	4512	5.18 (<0.05)	5.06	12.23	6.85
HL outlier	110	-2.81(<0.05)	5.29	8.68	6.50
LH outlier	108	-2.73 (<0.05)	0.79	3.61	2.79
LL cluster	4297	4.18 (<0.05)	0.69	6.43	1.48
Low proficiency in English					
Not significant	29216	0.43 (0.66)	0.00	17.48	0.89
HH cluster	3617	18.08 (<0.05)	2.81	37.95	9.64

HL outlier	0	0.00 (<0.00)	0.00	0.00	0.00
LH outlier	11	-2.69 (<0.05)	0.00	0.70	0.20
LL cluster	0	0.00 (<0.05)	0.00	0.00	0.00
Fulltime student					
Not significant	30673	0.35 (0.76)	1.17	59.26	7.33
HH cluster	2134	23.78 (<0.05)	10.56	93.91	28.55
HL outlier	27	-3.10 (<0.05)	19.60	58.99	33.60
LH outlier	10	-2.80 (<0.05)	3.44	6.58	5.63
LL cluster	0	0.00	0.00	0.00	0.00
Pensionable age and living alone					
Not significant	26753	0.19 (0.65)	0.1	32.79	7.12
HH cluster	2415	5.57 (<0.05)	8.04	36.02	14.06
HL outlier	220	-3.07 (<0.05)	9.17	41.5	14.48
LH outlier	217	-2.79 (<0.05)	0.28	5.75	3.28
LL cluster	3239	3.54 (<0.05)	0.00	5.24	2.63

[1] *Significant for a 95% confidence level*

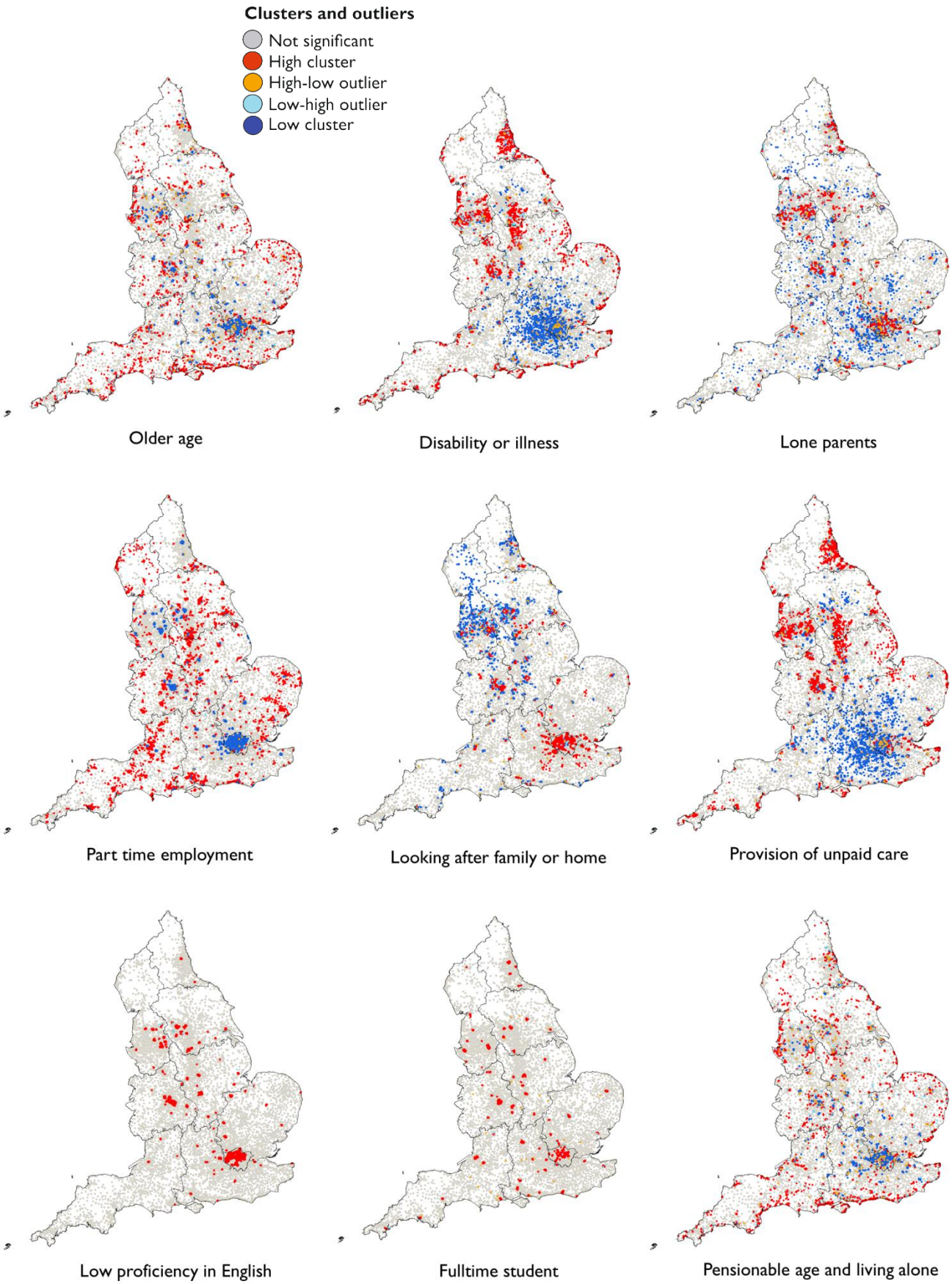

Figure 1. Clusters and outliers of gender-sensitive vulnerability indicators (ONS, 2011b.)

5. The gendered geographies of vulnerability to energy poverty

Five dimensions of gendered socio-spatial vulnerability to energy poverty are outlined: exclusion from the economy; time-consuming and unpaid reproductive, caring or domestic roles; susceptibility to negative physiological and mental health impacts; lack of social protection during a life course; and coping and helping others to cope. The nine gender-sensitive indicators identified interrelate with these five dimensions (Figure 2). Whilst the focus of the analysis is upon England, these dimensions are of relevance in understanding gendered aspects of vulnerability to energy poverty in other national contexts, in Europe and beyond. Although, as contended by Williams (2010) gender should be treated as contextually and culturally specific and the direct application of the dimensions is discouraged.

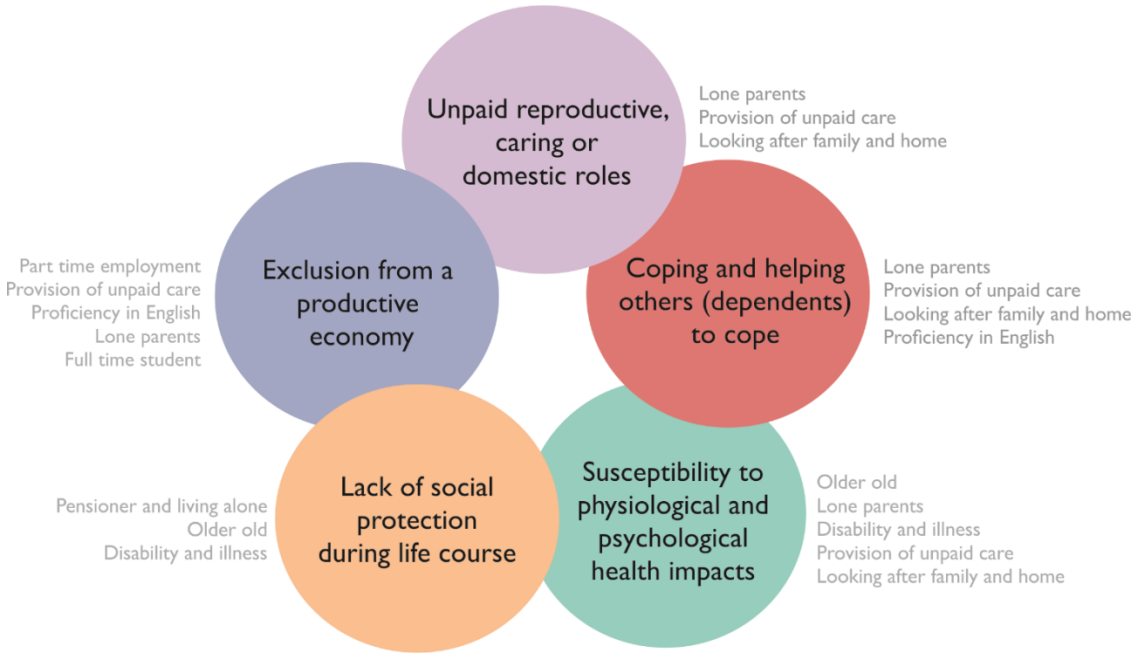

Figure 2. Dimensions of gendered vulnerability to energy poverty and associated indicators

5.1. Time-consuming and unpaid reproductive, caring or domestic roles

Ideas about what constitutes a 'productive' economy are highly problematic, devaluing domestic labour roles commonly carried out by women. Care for dependent children or those with a disability, illness or age-related needs is disproportionately provided by women (Pickard, 2015) as demonstrated by the indicators of unpaid care, lone parents and looking after the family or home. Of people who provide 20+ hours of unpaid care a week in England, approximately a third more are women. Meanwhile, 89% of lone parent families with dependent children are headed by a woman (ONS, 2011a.). Caring responsibilities leave women with less time for earning a living, more reliant upon precarious employment that provides the flexibility to accommodate these roles, and dependent to an extent upon male earnings (Pickard, 2015, Kwan 1999). There is also evidence of greater unpaid workloads amongst women including their responsibility for domestic labour, despite often also actively participating in the labour market (Hanson and Pratt, 1995). Such dynamics reduce financial flexibility and the ability to successfully negotiate the relationship between affordability and energy services or infrastructures within the home. In turn, the ability to make choices in everyday life and individual autonomy over energy services are reduced (Middlemiss and Gillard, 2015). Additionally, unpaid caring and domestic activities are more strongly fixed to a specified time or place (Schwanen et al., 2008) with implications for exposure to energy poverty due to prolonged time spent at home (Chard and Walker, 2016, Healy and Clinch, 2004).

In the cluster analyses (Figure 1), the unpaid care indicator has a relatively distinct geographical distribution, with unpaid, female carers concentrating in post-industrial, urban conurbations in the north of England, and coastal communities. These areas tend to experience a relatively acute income deprivation, suggesting that the household is likely to

be less able to afford the provision of care or childcare (Fernández-Bilbao, 2011) and are often characterised by either a relatively high percentage of lone parents caring for dependent children or people with a disability or illness that tend to have greater care requirements.

5.2. Exclusion from a 'productive' economy

Low incomes and the subsequent inability to afford energy bills and invest in efficient infrastructures are central to energy poverty (Boardman, 1991). Despite evidence over recent decades in the Global North of a change in women's aspirations and economic activities, systemic discrimination and inequalities continue to exist in the labour market (Rubery 2015). Feminisation of the labour market has focused upon flexible labour, a flexibility that is designed to facilitate the gendered caring or domestic roles discussed. Although less likely than their male counterparts to be unemployed (Table 3), a high percentage of women are either in part-time employment or are fulltime students (Figure 3). Kabeer (2011) describes a gender-specific poverty-trap in low income households, where women who are denied access to regular and well-paid employment are unable to purchase the means of reducing the demand of unpaid labour on their time and are therefore trapped in low-paid, precarious employment. Hochschild (2003) also provides evidence of a 'time-bind' in which women have a double burden of paid work and the bulk of caring responsibilities at home, a time-bind that is also intergenerational as grandparents increasingly assume caring responsibilities for children (Ward et al, 2007). Economic exclusion is also related to other forms of social inequality including the disproportionate number of women without proficiency in English. In addition to exclusion, for every hour worked women are paid less on average than their male counterparts, with women in the

EU earning over 16% less per hour worked, a gap that increases with age (European Commission, 2017). The pay gap also intersects with other forms of social difference, for example, in the UK disabled men experience a pay gap of 11% compared to non-disabled men, whilst for disabled and non-disabled women the gap in pay doubles to 22% (Papworth Trust, 2016). As discussed in relation to caring responsibilities, women's greater dependence upon male earners can undermine their financial flexibility and ability to negotiate the relationship between affordability and energy services. However, vulnerability to energy poverty associated with economic exclusion is often most acute amongst lone parents who do not have a second earner to rely upon and are disproportionately women (Gingerbread, 2013, Healy and Clinch, 2004). Lone parenting responsibilities makes engagement in full time employment and subsequently covering energy bills more difficult (Gingerbread, 2013).

The gendered geographies associated with economic exclusion are divergent, highlighting the multi-faceted nature of gendered vulnerability associated with labour (Figure 1). As shown, exclusion of dependents or unpaid carers is concentrated in large urban conurbations, especially post-industrialised, northern cities. In contrast, the part-time employment indicator recognises relative vulnerability in large swathes of rural areas and low vulnerability in urban conurbations, possibly highlighting areas where part-time work supplements retirement.

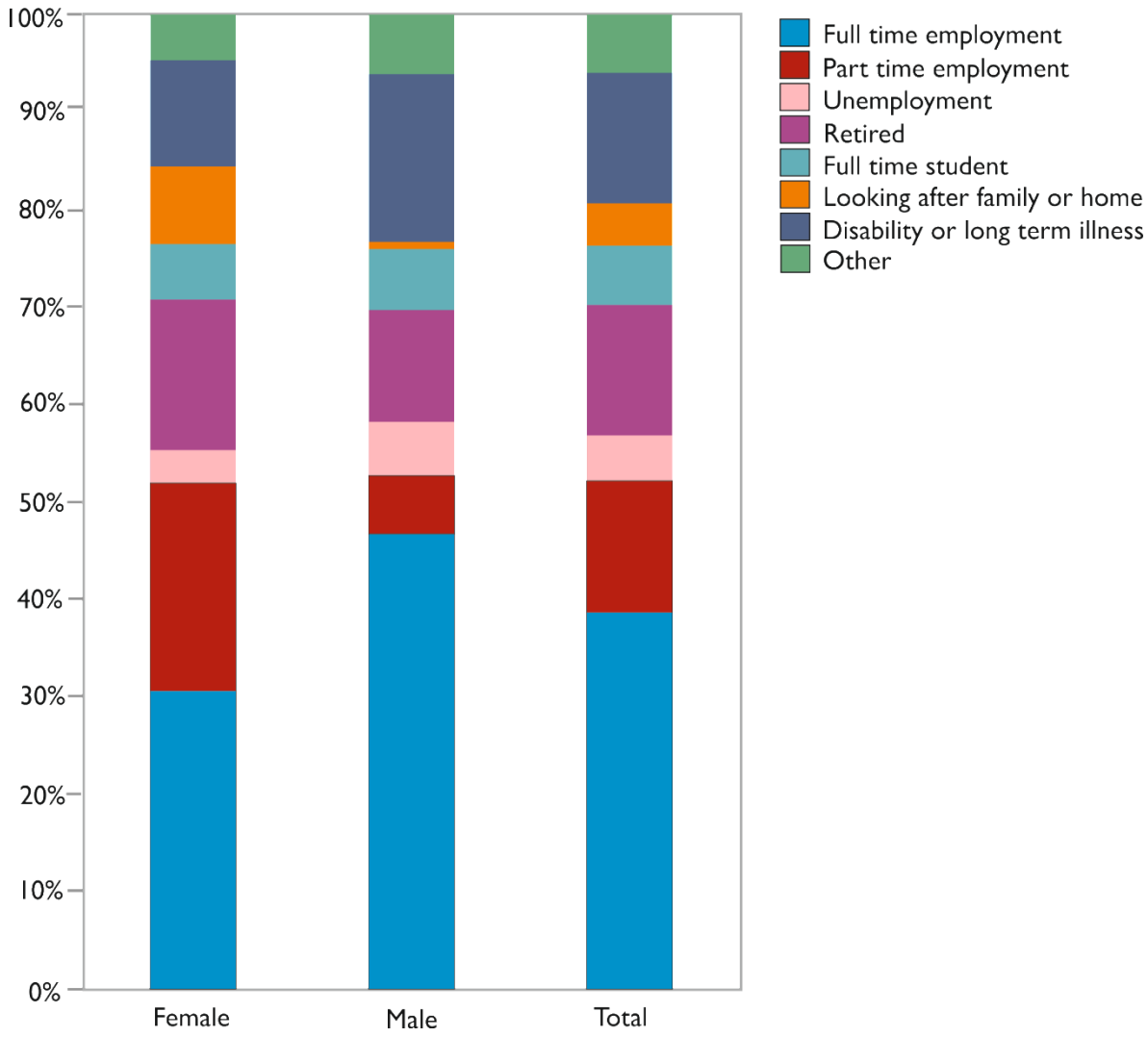

Figure 3. Economic (in)activity of persons aged 16-74 years broken down by sex (ONS, 2011a.)

5.3. Exposure and susceptibility to the negative physiological and mental health impacts of being without sufficient energy services

Gender plays a role in the physiological and psychological experience of health (Vlassoff, 2007). Here, women are overrepresented by indicators representing older age and disability and illness, groups that are more likely to experience the negative physiological impacts of energy poverty including being without sufficient warmth or coolth (Chard and Walker, 2016, Snell et al., 2015). Women also tend to be more sensitive to ambient temperature

(Clancy et al., 2017). Concerning older age, although Wilkinson et al. (2004) recognise that older women are slightly less exposed to winter mortality, they do not consider their overrepresentation in older age groups, with almost a third more women aged over 75 years in England (ONS, 2011a.). Despite a higher life expectancy, women are more likely to suffer from ill health during these years (Vlassoff, 2007). Physiological vulnerability is particularly acute when combined with a lack of social protection in older age, addressed in the following theme. Concerning disability and illness, increased need for other energy services related to specific health conditions is likely to enhance vulnerability. People with a disability or illness are also less likely to be engaged in full time employment (Snell et al., 2015) and thus the interconnections between disability and gender compound exclusion from the labour market. Additionally, Stafford et al. (2015) recognises that gender roles mean women are often more exposed to their immediate, local environment. Women fulfilling caring or domestic roles are likely to spend more time at home increasing exposure to a lack of heating and associated negative health impacts.

In addition to physiological health, energy poverty has a significant impact upon mental health owing to poor living conditions, energy-related debts, reduced privacy and pressure to cope with negative outcomes (Snell et al., 2015). Gender-sensitive indicators allow for limited exploration of these aspects of vulnerability, not least because mental health has rarely translated into sub-regional quantitative metrics and is under-researched in relation to energy poverty. However, evidence of the final theme of coping suggests that energy poverty is likely to disproportionately impact upon the mental health of women. For example, women living in poverty and with responsibility for dependents report feeling 'chronically exhausted, tired, stressed and overwhelmed' (Breitkreuz et al., 2010: 58).

5.4. Lack of social protection during life course

A significant body of work highlights energy-related vulnerabilities amongst older people, especially those on a low income, state pension or living alone (Chard and Walker, 2016, Wilkinson et al., 2004). Fraser (1994) discusses how social protection, including financial support during older age, tends to be linked to employment. Due to the gendered division of labour, women are less likely than men to accrue a substantial pension. A Fair Deal for Women (2016) highlight how a woman's personal pension is 62% of the average man, whilst of £82 billion in tax increases and cuts to social security in 2010, 81% came from women. During older age, women are more likely to be exposed to energy poverty due to the interaction between reduced financial capacity and increased physiological vulnerability. This is made more acute by the increased likelihood of women of a pensionable age living alone, a phenomenon that can make heating the home and affording energy bills problematic without support financially from another person, particularly under-occupied or energy inefficient properties (Healy and Clinch, 2004).

Indicators associated with a lack of protection throughout the life course concentrate in relatively remote rural areas and coastal communities that have a higher percentage of people in older age groups. At this point, it is worth reflecting upon the temporalities of gendered energy poverty. Vulnerability associated with unpaid caring roles and exclusion from a productive economy, typically associated with working age adults, can translate into gendered vulnerabilities in the future with regards to accruing a substantial pension.

5.5. Coping and helping others to cope

Finally, as poverty debates highlight *'income shocks'* (Thorbecke 2007), energy poverty research recognises the incidence of '*cold weather shocks'* in low income households (Bhattacharya et al. 2003), both instances in which consumption cannot be smoothed and therefore coping mechanisms must be employed. Examples of such coping mechanisms include going without energy services or managing the subsequent debt from necessarily overspending (Middlemiss and Gillard, 2015). Similarly, a more constant and high need for energy services due to disability, illness or age also impacts upon ability to cope (Snell *et al*., 2015). In wider literatures concerned with poverty, responsibility for a household coping is more likely to fall to women (Chant, 2006). Bondi et al. (2000) recognise how under conditions of material stress (such as energy poverty) long-standing gender divisions tend to be intensified. For example, participants in a project about empowering women experiencing poverty described 'sacrificing their own food, clothing, heat and other basic needs in order to put their families first' (Joseph Rowntree Foundation, 2002: 9). This relatively private aspect of vulnerability is not well represented by sub-regional, quantitative datasets (Buzar 2007), however, coping is disproportionately associated with several gender-sensitive indicators, namely lone parents, unpaid carers and those looking after the family or home (Breitkreuz et al., 2010). In addition, there are gendered aspects to these vulnerabilities that can make coping harder, for example, a greater proportion of women are unable to speak the local language well or at all, a factor that may affect coping mechanisms including the ability to switch to cheaper tariffs (Lorenc et al., 2013). Conversely, women are often less likely to receive support from others with coping, for example, in dealing with a health condition (Vlassoff, 2007).

5.6. Spatial intersections of gendered vulnerability to energy poverty

In recognising the limitations of gender as a single analytical category (McCall, 2005), feminist scholars have drawn attention to its intersection with other forms of social difference reflecting a concern with *which* women are experiencing vulnerability to (energy) poverty (Beneria and Roldan, 1987, Crenshaw, 1991). Interconnections between gender and other forms of social differentiation are touched upon in the five dimensions of gendered energy vulnerability recognising gender's intersection with age, disability and ethnicity. To further this, Figure 4 explores the *spatial* intersection of gendered aspects of vulnerabilities. For each LSOA, the number of HH clusters according to the gendered-sensitive indicators are mapped. Analysis of the spatial intersections between the indicators reveals an uneven patchwork of gendered vulnerability across England in relation to securing adequate energy services in the home. The greatest concentrations of HH clusters are found in large urban conurbations, primarily Birmingham, Manchester, Leeds, Liverpool, Sheffield and Newcastle. Here, gendered vulnerability associated with unpaid caring and domestic roles combine with the indicators representative of low proficiency in English and full-time students, typically more transient groups likely excluded from the labour market. London is not highlighted due to the low level of disability and illness in the capital city, partly attributed to the younger age population as a result of employment opportunities (ONS, 2011a.). However, caring and domestic roles carried out by lone parents are also spatially concentrated in London. In contrast, the gendered vulnerability associated with older age groups, especially those living alone, that include a susceptibility to negative physiological impacts and a lack of a substantial pension contribution, spatially concentrate in relatively isolated rural and coastal areas. As highlighted in Figure 4, these LSOA tend to be associated with a lower number of HH clusters (perhaps only two or three), as they have fewer associations with other indicators, namely with the part-time employment indicator. However, the spatial

distribution of gendered vulnerability related to disability and illness spans these distributions, concentrating in urban conurbations outside London with a high percentage of unpaid care, but also spatially intersecting with indicators associated with older age, a group who are more likely to suffer from a disability or illness, particularly in deprived coastal communities. Gender and energy poverty therefore have a distinct and diverse spatiality that is unlikely to be accounted for in traditional poverty and fuel poverty metrics that are often predicated upon an urban versus rural deprivation binary (Robinson et al., 2017).

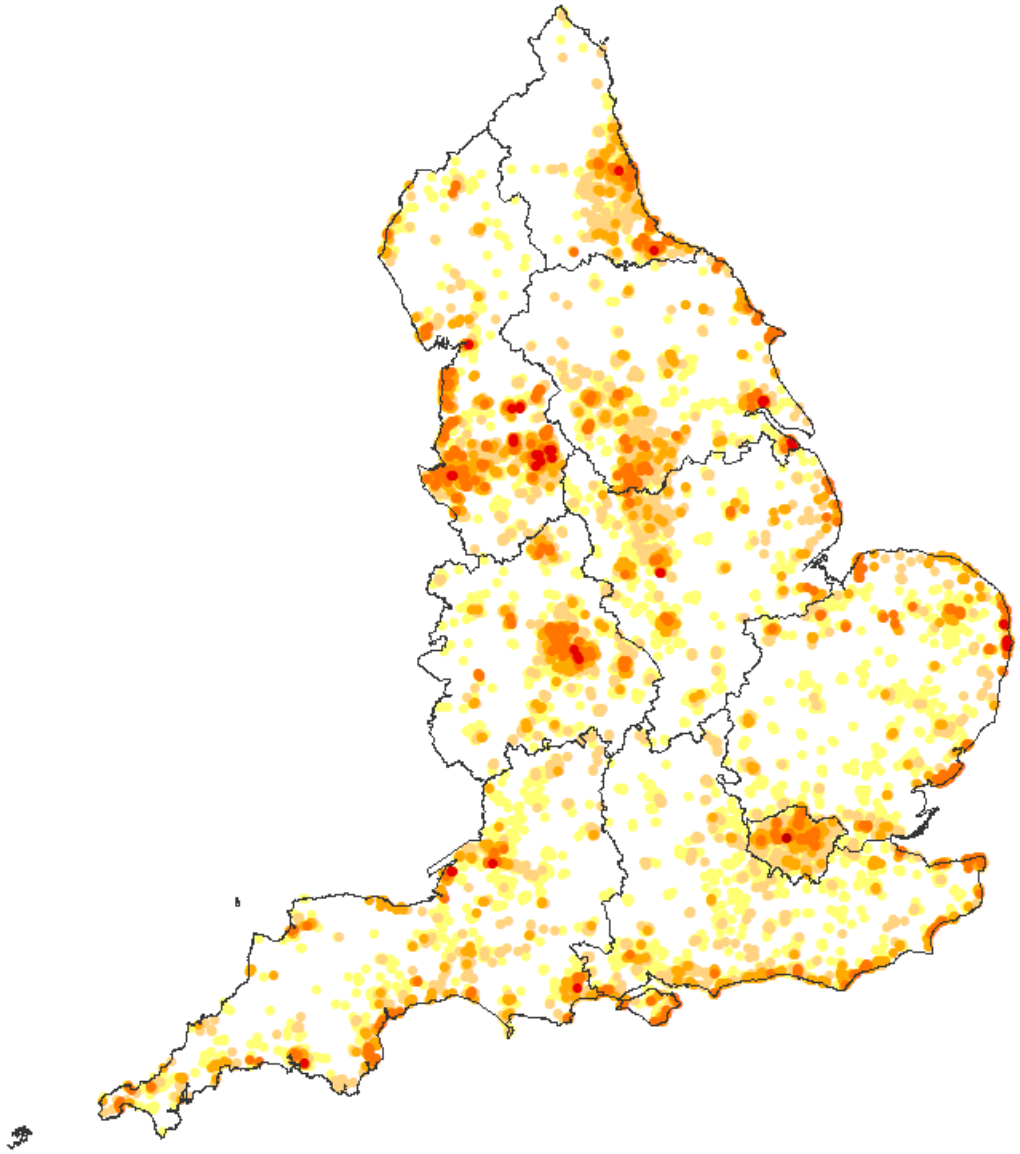

Figure 4. Spatial intersection of HH clusters according to gender-sensitive vulnerability indicators

(ONS 2011b.)

6. Conclusion

Substantial inequalities exist in domestic energy provision, sustained and produced by a neo-liberal, austerity-oriented economic system. One way in which these inequalities are shaped is through highly socio-spatially contingent gender relations (McDowell, 1999, Massey, 1994), an area underexplored with regards to energy poverty (Listo, 2018).

The central aim of the paper was to uncover the spatialities of gender and energy poverty for a case study of England. In fulfilling this aim, I respond to several recent calls in energy poverty literatures. Firstly, the findings contribute towards an understanding of the relationship between gender and energy poverty that reaches beyond a "feminization of energy deprivation" (Petrova and Simcock, Under review: 1) and the binary, disempowering and victimising gender discourses that dominate existing research (Listo, 2018). Secondly, the analysis fulfils a need for research that scrutinises the uneven, gendered geographies of energy deprivation (Petrova and Simcock, Under review). Thirdly, it contributes towards a better understanding of the relationship between gender and energy poverty, and subsequently gender-sensitive measurement approaches, in the context of the Global North (Clancy et al., 2017).

Through the derivation of gender-sensitive vulnerability indicators, five dimensions that enhance the likelihood of women and other marginalised groups experiencing energy poverty have been evidenced: exclusion from a productive economy; unpaid caring or domestic roles; susceptibility to negative physiological and mental health impacts; a lack of social protection throughout a life course; and coping and helping others to cope. Analysis of the indicators recognises how, in conjunction with other forms of social difference, gender plays a significant role in energy vulnerability. The intersection of gender with age,

able-ness and ethnicity gives rise to diverse and contradictory geographies of gendered vulnerability to energy poverty.

Many of the gendered dimensions of energy vulnerability identified have a significant overlap with experience of wider forms of income or material poverty, an overlap that Middlemiss (2016) considers to be downplayed in existing efforts to research and tackle energy poverty. The analysis here deliberately engages with literatures concerned with poverty, partly because of the absence of exploration of gender in energy poverty debates to date, but primarily owing to the significant role of labour markets and state support during older age in experience of poverty and energy poverty. Despite these similarities, and the recognition of opportunities for cross-fertilisation between the two research agendas, the vulnerability dimensions identified are also inherently bound up with the energy-related activities and infrastructures that distinguish energy poverty from other forms of deprivation (Boardman 2010).

The paper also demonstrates how a vulnerability framing, increasingly used to understand a household's exposure to energy poverty (Bouzarovski and Petrova, 2015, Middlemiss and Gillard, 2015), offers a means of challenging the assumption that gender inequality is entirely synonymous with energy poverty and underpins understanding of the socio-spatial dynamics of gender and energy poverty. However, the paper evidences a need for existing energy vulnerability debates to move beyond the household as the primary focus of analysis, to also recognise the individual.

There are several aspects of the conceptual and methodological approach of deriving gender-sensitive indicators of vulnerability to energy poverty that necessitate reflection. Due to restrictions regarding neighbourhood-scale datasets, comprised of individuals rather than households, the analysis is what McCall (2005) terms inter-categorical, *necessarily* adopting

existing analytical categories (including women and men) to highlight processes of marginalisation. Despite having a useful role in making visible the positions and outlooks of women (DeVault, 1996) such categorisations can obscure a variety of identities (Butler, 1990, Valentine, 2007). The focus upon the individual as the unit of analysis within the neighbourhood aggregation of data means that several aspects of vulnerability are overlooked. For example, data concerning the built environment is only available for households making it difficult to consider the gender relations between household members and these infrastructures. An inability to simultaneously disaggregate individual-scale datasets by various forms of social difference necessitates what is a relatively crude, additive method to examine geographical intersections between gendered vulnerabilities. Additionally, not every aspect of gender inequality is amenable to quantification, for example, energy-related household practices (Middlemiss and Gillard, 2015), the emotional labour of energy poverty (Petrova and Simcock, Under review) or the domestic, tech-work of the smart home (Strengers and Nicholls, 2017).

Such limitations mean that neighbourhood-scale, quantitative assessments are likely to insufficiently representing the multi-faceted inequalities associated with gender and should therefore be underpinned by in-depth qualitative research (Chant, 2006). Whilst it is possible to draw conclusions regarding gendered vulnerability associated with health and economic activity, this is more complex in relation to energy-related infrastructures that play a vital role in enhancing vulnerability to energy poverty. The findings therefore highlight the diverse array of gendered, socio-spatial vulnerabilities that exist in relation to energy poverty, however, they are also intended to stimulate further conversations about gender and energy poverty.

References

A Fairer Deal for Women (2016) Fair Deal for Women – Report 2016. Part 1: Women Speak Out on the Economy and Work and Family Life [online] < https://fairdealforwomen.com/fair-deal-for-women-report-launch-part-1/>

Adger, W. N. (2006) Vulnerability. *Global environmental change*, *16*(3), 268-281.

Anselin, L. (1995) Local indicators of spatial association—LISA. *Geographical analysis*, *27*(2), 93-115.

Benería, L., and Roldan, M. (1987) *The crossroads of class and gender: Industrial homework, subcontracting, and household dynamics in Mexico City*. University of Chicago Press.

Bessell, S. (2015) The individual deprivation measure: Measuring poverty as if gender and inequality matter. *Gender and Development*, *23*(2), 223-240.

Bhattacharya, J., DeLeire, T., Haider, S., & Currie, J. (2003) Heat or eat? Cold-weather shocks and nutrition in poor American families. *American Journal of Public Health*, *93*(7), 1149-1154.

Boardman, B. (1991) *Fuel poverty: from cold homes to affordable warmth*. Pinter Pub Limited.

Bondi, L. and Christie, H. (2000) The best of times for some and the worst of times for others? Gender and class divisions in urban Britain today. *Geoforum*, *31*(3), 329-343.

Bouzarovski, S., and Petrova, S. (2015) A global perspective on domestic energy deprivation: Overcoming the energy poverty–fuel poverty binary. *Energy Research and Social Science*, *10*, 31-40.

Bouzarovski, S., and Thomson, H. (2018) Energy Vulnerability in the Grain of the City: Toward Neighborhood Typologies of Material Deprivation. *Annals of the American Association of Geographers*, *108*(3), 695-717.

Bouzarovski, S., Tirado Herrero, S., Petrova, S., Frankowski, J., Matoušek, R., and Maltby, T. (2017) Multiple transformations: theorizing energy vulnerability as a socio-spatial phenomenon. *Geografiska Annaler: Series B, Human Geography*, *99*(1), 20-41.

Bradshaw, S. (2002) *Gendered poverties and power relations: looking inside communities and households*. Puntos de Encuentro.

Breitkreuz, R. S., Williamson, D. L., and Raine, K. D. (2010) Dis-integrated policy: welfare-to-work participants' experiences of integrating paid work and unpaid family work. *Community, Work and Family*, *13*(1), 43-69.

Butler, J. (1990) Gender trouble, feminist theory, and psychoanalytic discourse. *Feminism/postmodernism*, *327*.

Buzar, S. (2007) *Fuel poverty in Eastern Europe: hidden geographies of deprivation*. Ashgate Publishing, Ltd.

Chant, S. (2004) Dangerous Equations? How Female-headed Households Became the Poorest of the Poor: Causes, Consequences and Cautions. *IDS bulletin*, *35*(4), 19-26.

Chant, S. (2006) Re-thinking the "feminization of poverty" in relation to aggregate gender indices. *Journal of human development*, *7*(2), 201-220.

Chant, S. (2008) The 'feminisation of poverty'and the 'feminisation'of anti-poverty programmes: Room for revision?. *The Journal of Development Studies*, *44*(2), 165-197.

Chard, R., and Walker, G. (2016) Living with fuel poverty in older age: Coping strategies and their problematic implications. *Energy Research and Social Science*, *18*, 62-70.

Clancy, J., Daskalova, V., Feenstra, M., Franceschelli, N., Sanz M. (2017) *Gender perspective on access to energy in the EU.* European Parliament. [online] < http://www.europarl.europa.eu/RegData/etudes/STUD/2017/596816/IPOL_STU(2017)596816_EN.pdf>

Crenshaw, K. (1991) Mapping the margins: Intersectionality, identity politics, and violence against women of color. *Stanford law review*, 1241-1299.

Cutter, S. L., Boruff, B. J., and Shirley, W. L. (2003) Social vulnerability to environmental hazards. *Social science quarterly*, *84*(2), 242-261.

Davis, K. (2008) Intersectionality as buzzword: A sociology of science perspective on what makes a feminist theory successful. *Feminist theory*, *9*(1), 67-85.

Day, R., and Hitchings, R. (2011) 'Only old ladies would do that': Age stigma and older people's strategies for dealing with winter cold. *Health and place*, *17*(4), 885-894.

DeVault, M. L. (1996) Talking back to sociology: Distinctive contributions of feminist methodology. *Annual review of sociology*, *22*(1), 29-50.

European Commission (2017) *Gender pay gap.* [online] < http://ec.europa.eu/justice/gender-equality/gender-pay-gap/index_en.htm>

Fernández-Bilbao, A. (2011) An ageing population and a changing climate: The case of coastal communities in the UK. *Psyecology*, *2*(3), 349-355.

Fraser, N. (1994) After the family wage: Gender equity and the welfare state. *Political theory*, *22*(4), 591-618.

Gingerbread (2013) Paying the Price: Single parents in the age of austerity. [online] Available at: <http://www.gingerbread.org.uk/uploads/media/17/8737.pdf> [Accessed 31st October 2017]

Glenn, E. N. (1985) Racial ethnic women's labor: The intersection of race, gender and class oppression. *Review of Radical Political Economics*, *17*(3), 86-108.

Hanson, S., and Pratt, G. (1995) *Gender, work, and space*. Psychology Press.

Healy, J. D., and Clinch, J. P. (2004) Quantifying the severity of fuel poverty, its relationship with poor housing and reasons for non-investment in energy-saving measures in Ireland. *Energy Policy*, *32*(2), 207-220.

Hochschild, A. R. (2003) The time bind: When work becomes home and home becomes work. *The Cultural Study of Work*, 261-72.

Jackson, C. (1996). Rescuing gender from the poverty trap. *World development*, *24*(3), 489-504.

Joseph Rowntree Foundation (JRF) and Women's Budget Group (WBG) (2008) Women and poverty: Experiences, empowerment and engagement. [online] Available at: <https://www.jrf.org.uk/sites/default/files/jrf/migrated/files/2186-women-poverty-policy.pdf>

Kabeer, N. (2011) Gendered poverty traps: Inequality and care in a globalised world. *The European Journal of Development Research*, *23*(4), 527-530.

Kwan, M. P. (1999) Gender, the home-work link, and space-time patterns of nonemployment activities. *Economic geography*, *75*(4), 370-394.

Listo, R. (2018) Gender myths in energy poverty literature: A Critical Discourse Analysis. *Energy Research and Social Science*, *38*, 9-18.

Lorenc, A., Pedro, L., Badesha, B., Dize, C., Fernow, I., and Dias, L. (2013) Tackling fuel poverty through facilitating energy tariff switching: a participatory action research study in vulnerable groups. *public health*, *127*(10), 894-901.

Massey, D. (1994) Place, space and gender. *University of Minnesota, Minneapolis*.

McCall, L. (2005) The complexity of intersectionality. *Signs: Journal of women in culture and society*, *30*(3), 1771-1800.

McDowell, L. (1999) Gender, identity and place: Understanding feminist geographies. *Polity Press: Oxford.*

McDowell, L. (2007) Respect, deference, respectability and place: What is the problem with/for working class boys?. *Geoforum*, *38*(2), 276-286.

McDowell, L. (2016) Reflections on feminist economic geography: Talking to ourselves?. *Environment and Planning A*, *48*(10), 2093-2099.

McLafferty, S. L. (1995) Counting for women. *The Professional Geographer*, *47*(4), 436-442.

Middlemiss, L. (2017) A critical analysis of the new politics of fuel poverty in England. *Critical Social Policy*, *37*(3), 425-443.

Middlemiss, L., and Gillard, R. (2015) Fuel poverty from the bottom-up: Characterising household energy vulnerability through the lived experience of the fuel poor. *Energy Research and Social Science*, *6*, 146-154.

Millar, J., and Glendinning, C. (1989) Gender and poverty. *Journal of Social Policy*, *18*(3), 363-381.

Office for National Statistics (ONS) (2011a.) Nomis: 2011 Census Data. [online] <https://www.nomisweb.co.uk/census/2011>

Office for National Statistics (ONS) (2011b.) Census boundary dataset, Lower Super Output Area. [online] <https://data.gov.uk/dataset/lower_layer_super_output_area_lsoa_boundaries>

Papworth Trust (2016) Disability in the UK 2016: Facts and Figures. [online]: < http://www.papworthtrust.org.uk/sites/default/files/Disability%20Facts%20and%20Figures%202016.pdf>

Pearce, D. (1978) The feminization of poverty: Women, work, and welfare. *Urban and social change review*.

Perrons, D. (2015) Gendering the inequality debate. *Gender and Development*, *23*(2), 207-222.

Petrova, S. (2017) Encountering energy precarity: Geographies of fuel poverty among young adults in the UK. *Transactions of the Institute of British Geographers*.

Petrova and Simcock (Under review) Gender and energy: Domestic inequities considered. *Unpublished manuscript.*

Pickard, L. (2015) A growing care gap? The supply of unpaid care for older people by their adult children in England to 2032. *Ageing and Society*, *35*(1), 96-123.

Razavi, S. (1999). Seeing poverty through a gender lens. *International Social Science Journal*, *51*(162), 473-482.

AUTHOR (Under Review) Neighbourhood geographies of fuel poverty: Understanding localised vulnerability using geographically weighted methodologies. *Unpublished manuscript.*

Robinson, C., Bouzarovski, S., and Lindley, S. (2017) 'Getting the measure of fuel poverty': The geography of fuel poverty indicators in England. *Energy Research and Social Science*.

Rubery, J. (2015) Austerity and the future for gender equality in Europe. *ILR Review*, *68*(4), 715-741.

Schwanen, T., Kwan, M. P., and Ren, F. (2008) How fixed is fixed? Gendered rigidity of space–time constraints and geographies of everyday activities. *Geoforum*, *39*(6), 2109-2121.

Sen, A. (1999) Commodities and capabilities. *OUP Catalogue*.

Shields, S. A. (2008) Gender: An intersectionality perspective. *Sex roles*, *59*(5-6), 301-311.

Snell, C., Bevan, M., and Thomson, H. (2015) Justice, fuel poverty and disabled people in England. *Energy Research and Social Science*, *10*, 123-132.

Sprague, J., & Zimmerman, M. K. (1993). Overcoming dualisms: A feminist agenda for sociological methodology. *Theory on gender/feminism on theory*, 255-280.

Stafford, M., Cummins, S., Macintyre, S., Ellaway, A., and Marmot, M. (2005) Gender differences in the associations between health and neighbourhood environment. *Social science and medicine*, *60*(8), 1681-1692.

Strengers, Y., and Nicholls, L. (2017) Aesthetic pleasures and gendered tech-work in the 21st-century smart home. *Media International Australia*, 1329878X17737661.

Thorbecke, E. (2007) Multidimensional poverty: Conceptual and measurement issues. In *The many dimensions of poverty* (pp. 3-19). Palgrave Macmillan UK.

Tirado Herrero, S. T. (2017) Energy poverty indicators: A critical review of methods. *Indoor and Built Environment*, *26*(7), 1018-1031.

Townsend, P. (1979) *Poverty in the UK: a survey of household resources and standards of living*. Univ of California Press.

Valentine, G. (2007) Theorizing and researching intersectionality: A challenge for feminist geography. *The professional geographer*, *59*(1), 10-21.

Vlassoff, C. (2007) Gender differences in determinants and consequences of health and illness. *Journal of health, population, and nutrition*, *25*(1), 47.

Walker, G., and Day, R. (2012) Fuel poverty as injustice: Integrating distribution, recognition and procedure in the struggle for affordable warmth. *Energy policy*, *49*, 69-75.

Waller, L. A., & Gotway, C. A. (2004). Spatial clusters of health events: Point data for cases and controls. *Applied Spatial Statistics for Public Health Data*, 155-199.

Ward, K., Fagan, C., McDowell, L., Perrons, D., and Ray, K. (2007) Living and working in urban working class communities. *Geoforum*, *38*(2), 312-325.

Wilkinson, P., Pattenden, S., Armstrong, B., Fletcher, A., Kovats, R. S., Mangtani, P., and McMichael, A. J. (2004) Vulnerability to winter mortality in elderly people in Britain: population based study. *Bmj*, *329*(7467), 647.

Williams, J. R. (2010) Doing feminist-demography. *International Journal of Social Research Methodology*, *13*(3), 197-210.